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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/049,615	02/21/2002	Hiroshi Yoshida	011362	2567

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ARMSTRONG, WESTERMAN & HATTORI, LLP
1725 K STREET, NW
SUITE 1000
WASHINGTON, DC 20006

EXAMINER

SONG, MATTHEW J

ART UNIT

PAPER NUMBER

1765

DATE MAILED: 03/20/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

10/049,615

Applicant(s)

YOSHIDA ET AL.

Examiner

Matthew J Song

Art Unit

1765

— The MAILING DATE of this communication appears on the cover sheet with the correspondence address —
Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 21 February 2002.
- 2a) ☐ This action is FINAL. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-4 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-4 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on _____ is: a) ☐ approved b) ☐ disapproved by the Examiner.
If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

- 13) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
a) ☒ All b) ☐ Some * c) ☐ None of.
- 1) ☐ Certified copies of the priority documents have been received.
- 2) ☐ Certified copies of the priority documents have been received in Application No. _____.
- 3) ☒ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftperson's Patent Drawing Review (PTO-948)
- 3) ☒ Information Disclosure Statement(s) (PTO-1449) Paper No(s) 5.
- 4) ☐ Interview Summary (PTO-413) Paper No(s) _____.
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: _____.

DETAILED ACTION

Claim Objections

1. Claim 3 is objected to because of the following informalities: Claim 3 recites, "in which when an atomic gas" in line 3. The language is confusing and the examiner suggests deleting "when". Appropriate correction is required.

Claim Rejections - 35 USC § 112

2. The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

3. Claim 1 is rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. Claim 1 recites, "including a transition metal element consisting of Mn, and a p-type dopant" in lines 1-2. It is unclear if applicant is claiming a Markush group consisting of Mn and a p-type dopant or if applicant is claiming a ZnO with Mn and a p-type dopant, where Mn is the only element of the Markush group defining a transition metal.

4. Claim 2 is rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. Claim 2 recites, "including a transition metal element consisting of Mn, a p-type dopant and an n-type dopant" in lines 1-2. It is unclear if applicant is claiming a Markush group consisting of Mn, a p-type dopant and a n-type dopant or if applicant is claiming a ZnO with Mn,

a p-type dopant and a n-type dopant, where Mn is the only element of the Markush group defining a transition metal.

Double Patenting

5. The nonstatutory double patenting rejection is based on a judicially created doctrine grounded in public policy (a policy reflected in the statute) so as to prevent the unjustified or improper timewise extension of the "right to exclude" granted by a patent and to prevent possible harassment by multiple assignees. See *In re Goodman*, 11 F.3d 1046, 29 USPQ2d 2010 (Fed. Cir. 1993); *In re Longi*, 759 F.2d 887, 225 USPQ 645 (Fed. Cir. 1985); *In re Van Ornum*, 686 F.2d 937, 214 USPQ 761 (CCPA 1982); *In re Vogel*, 422 F.2d 438, 164 USPQ 619 (CCPA 1970); and, *In re Thorington*, 418 F.2d 528, 163 USPQ 644 (CCPA 1969).

A timely filed terminal disclaimer in compliance with 37 CFR 1.321(c) may be used to overcome an actual or provisional rejection based on a nonstatutory double patenting ground provided the conflicting application or patent is shown to be commonly owned with this application. See 37 CFR 1.130(b).

Effective January 1, 1994, a registered attorney or agent of record may sign a terminal disclaimer. A terminal disclaimer signed by the assignee must fully comply with 37 CFR 3.73(b).

6. Claims 1-2 are provisionally rejected under the judicially created doctrine of obviousness-type double patenting as being unpatentable over claims 1-9 of copending Application No. 09/696,013. Although the conflicting claims are not identical, they are not patentably distinct from each other because the claimed compound of Application 09/696013 suggest the compound and method of the present invention. Application no. 09/696,013 claims a ferromagnetic ZnO type compound with a single crystalline structure added with at least Mn and at least one of an n-type and p-type dopant (claim 4).

This is a provisional obviousness-type double patenting rejection because the conflicting claims have not in fact been patented.

7. Claim 3 is provisionally rejected under the judicially created doctrine of obviousness-type double patenting as being unpatentable over claims 1-9 of copending Application No. 09/696,013 in view of Schetzina (US 5,679,965). Application no. 09/696,013 claims a ferromagnetic ZnO type compound with a single crystalline structure added with at least Mn and at least one of an n-type and p-type dopant (claim 4). Application no. 09/696,013 does not claim an atomic gas from a solid-state source of Zn or Zn oxide and an activated oxygen are supplied onto a semiconductor substrate to grow a single crystal zinc oxide thin film on the substrate, an atomic p-type dopant and an atomic Mn are supplied all together onto a substrate.

In a method of forming ZnO by Molecular beam epitaxy (MBE), Schetzina teaches a MBE source for molecular zinc of zinc metal and an oxygen plasma source and additional source ports can be added to the system for MBE deposition of other materials including dopants for deposition of ZnO on a substrate (col 20, ln 55 to col, 21, ln 67). It would have been obvious to a person of ordinary skill in the art at the time of the invention to modify Application no. 09/696,013 with Schetzina's method of forming ZnO by MBE to form a high quality ZnO (col 19, ln 1 to col 20, ln 20).

This is a provisional obviousness-type double patenting rejection.

8. Claim 4 is provisionally rejected under the judicially created doctrine of obviousness-type double patenting as being unpatentable over claims 1-9 of copending Application No. 09/696,013 in view of Schetzina (US 5,679,965) and Yamamoto et al ("Solution Using a Codoping Method to Unipolarity for the Fabrication of p-type ZnO"). The combination of

Application no. 09/696,013 and Schetzina teach all of the limitations of claim 4, as discussed previously, except the n-type dopant is doped so as to provide a higher concentration of the p-type dopant than that of the n-type dopant.

Yamamoto et al teaches codoping ZnO with p-type dopant and n-type dopants and p-type ZnO: (Al, 2N), this reads on applicant's p-type dopant with a higher concentration than a n-type dopant, and simultaneous codoping decreases the Madelung energy of p-type doped ZnO with p-type ZnO doped with a N acceptor alone (pg 168 and Fig 3). It would have been obvious to a person of ordinary skill in the art at the time of the invention to modify the combination of Application no. 09/696,013 and Schetzina with Yamamoto et al's codoping with Al,2N to fabricate a low resistivity p-type ZnO crystals.

This is a provisional obviousness-type double patenting rejection.

Claim Rejections - 35 USC § 102

9. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

10. Claims 1 rejected under 35 U.S.C. 102(b) as being anticipated by Yoon et al (US 5,368,764).

Yoon et al discloses Mn-Zn single crystal ferrite compound, where the composition contains a host material essentially consisting of 51 to 54 mole % Fe_2O_3 , 27 to 33 mole % MnO and 16 to 20 mole % ZnO and an additional material essentially consisting of 0.2 to 2 mole %

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SnO₂, 0.1 to 1 mole % CoO, 0.2 to 1 mole % CaCO₃ and 0.02 to 1 weight % V₂O₅ (col 3, ln 50 to col 4, ln 67). Ca and V are well-known p-type dopants for ZnO.

11. Claims 1 rejected under 35 U.S.C. 102(b) as being anticipated by Nishiyama et al (US 4,174,421).

Nishiyama et al discloses a crystalline zinc oxide film containing vanadium and manganese together with or without copper (abstract). Nishiyama et al also discloses the content of vanadium and manganese in the ZnO film is 0.01 to 20.0 atomic percent (claim 1). Cu and V are well-known p-type dopants for ZnO. Nishiyama et al is silent the ZnO film being a ferromagnetic p-type ZnO material, however this is inherent to Nishiyama et al. Nishiyama et al discloses a ZnO material containing similar dopants, as applicant, therefore a similar material will inherently have similar properties.

Claim Rejections - 35 USC § 103

12. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

13. Claim 2 is rejected under 35 U.S.C. 103(a) as being unpatentable over Yoon et al (US 5,368,764) or Nishiyama et al (US 4,174,421) in view of Yamamoto et al ("Solution Using a Codoping Method to Unipolarity for the Fabrication of p-type ZnO").

Yoon et al or Nishiyama et al teaches all of the limitations of claim 2, as discussed previously, except a zinc oxide including a n-type dopant.

In a method of codoping ZnO, note entire reference, Yamamoto et al teaches codoping ZnO with a p-type dopant and a n-type dopant to form p-type ZnO: (Al, 2N), this reads on applicant's p-type dopant with a higher concentration than a n-type dopant, and simultaneous codoping decreases the Madelung energy of p-type doped ZnO with p-type ZnO doped with a N acceptor alone (pg 168 and Fig 3). It would have been obvious to a person of ordinary skill in the art at the time of the invention to modify Yoon et al or Nishiyama et al with Yamamoto et al's codoping with p-type and n-type dopants to lower the resistivity.

14. Claim 3 is rejected under 35 U.S.C. 103(a) as being unpatentable over Yoon et al (US 5,368,764) or Nishiyama et al (US 4,174,421) in view of Schetzina (US 5,679,965).

Yoon et al or Nishiyama et al teaches all of the limitations of claim 3, as discussed previously, except the method of fabricating ZnO in which an atomic gas from a solid-state source of Zn or Zn oxide and an activated oxygen are supplied onto a semiconductor substrate to grow a single crystal zinc oxide thin film on the substrate, an atomic p-type dopant and an atomic Mn are supplied all together onto a substrate

In a method of forming ZnO by Molecular beam epitaxy (MBE), Schetzina teaches a MBE source for molecular zinc of zinc metal and an oxygen plasma source and additional source ports can be added to the system for MBE deposition of other materials including dopants for deposition of ZnO on a substrate (col 20, ln 55 to col, 21, ln 67). It would have been obvious to a person of ordinary skill in the art at the time of the invention to modify Yoon et al or Nishiyama

et al with Schetzina's method of forming ZnO by MBE to form a high quality ZnO (col 19, ln 1 to col 20, ln 20).

15. Claim 4 is rejected under 35 U.S.C. 103(a) as being unpatentable over Yoon et al (US 5,368,764) or Nishiyama et al (US 4,174,421) in view of Schetzina (US 5,679,965) as applied to claim 3 above, and further in view of Yamamoto et al ("Solution Using a Codoping Method to Unipolarity for the Fabrication of p-type ZnO").

The combination of Yoon et al and Schetzina or the combination of Nishiyama et al and Schetzina teach all of the limitations of claim 4, as discussed previously, except the n-type dopant is doped so as to provide a higher concentration of the p-type dopant than that of the n-type dopant.

Yamamoto et al teaches codoping ZnO with p-type dopant and n-type dopants and p-type ZnO: (Al, 2N), this reads on applicant's p-type dopant with a higher concentration than a n-type dopant, and simultaneous codoping decreases the Madelung energy of p-type doped ZnO with p-type ZnO doped with a N acceptor alone (pg 168 and Fig 3). It would have been obvious to a person of ordinary skill in the art at the time of the invention to modify the combination of Yoon et al and Schetzina or the combination of Nishiyama et al and Schetzina with Yamamoto et al's codoping with Al,2N to fabricate a low resistivity p-type ZnO crystals.

Conclusion

16. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

White et al (US 6,291,085) teaches a method of growing p-type ZnO, where Ca, Cu and V are suitable dopants (col 4, ln 1-25).

Bhargava et al (US 6,300,640) teaches a ZnO host material doped with manganese (col 9, ln 1-15).

Asai et al (US 5,393,444) teaches doping a ZnO single crystal with Li or a trivalent metal, such as Aluminum (Abstract and col 10, ln 25-35).

Imura et al (JP 56-063900) teaches a single crystal ferrite comprising manganese oxide and zinc oxide, which is used as a magnetic head material (Abstract).

17. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Matthew J Song whose telephone number is 703-305-4953. The examiner can normally be reached on M-F 9:00-5:00.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Benjamin L Utech can be reached on 703-308-3868. The fax phone numbers for the organization where this application or proceeding is assigned are 703-872-9310 for regular communications and 703-872-9311 for After Final communications.

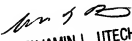
Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is 703-308-0661.

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Matthew J Song
Examiner
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MJS
March 18, 2003


BENJAMIN L. UTECH
SUPERVISORY PATENT EXAMINER
TECHNOLOGY CENTER 1700